Center Independent Research & Development: GSFC IRAD

Passive Microwave Instrument Studies for Next Generation Precipitation and Cloud Measurements

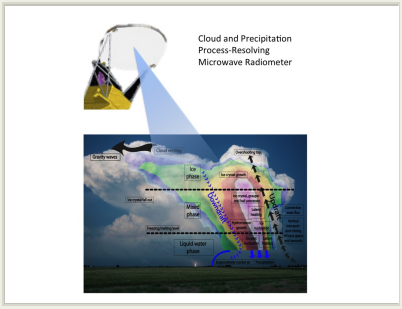
Completed Technology Project (2017 - 2018)

Project Introduction

We will formulate high-level concepts for passive microwave instrument candidates for next generation precipitation and cloud measurements. The results can be used in support of a Cloud and Precipitation Process Mission architecture study. Outcomes will include technology roadmaps and relative science performance evaluation for a small-satellite microwave imager (MI) oriented towards time-resolved process measurements, a balloon-borne microwave imager suitable for use in medium-duration (~4-6 week) campaigns, and a large-satellite MI with enhanced profiling capability, all considering architectures for including sub-millimeter-wave channels.

Anticipated Benefits

The cloud and precipitation science community desires process-oriented measurements to improve representation of cloud microphysical processes (e.g., snow aggregation, riming, onset of precipitation) to continue and expand the legacy of measurements from TRMM, CloudSat, and GPM. A process-oriented mission would *ideally* yield detailed profiles, **separating cloud and precipitation hydrometeor species, at horizontal resolution < 4km, vertical resolution < 250m, and temporally resolved on scales of < 30 minutes**. While these objectives would best be achieved using a combination of active and passive measurements on multiple satellites, advances in MI design are a minimum requirement to achieve the desired hydrometeor discrimination, horizontal, vertical, and temporal resolution. This study will provide detailed measurement requirements needed to achieve scientific understanding of cloud and precipitation processes and then formulate instrument concepts that can provide these measurements.



A schematic diagram of a thunderstorm with internal microphysical processes labeled (courtesy of Sue van den Heever and Rob Seigel, Colorado State University).

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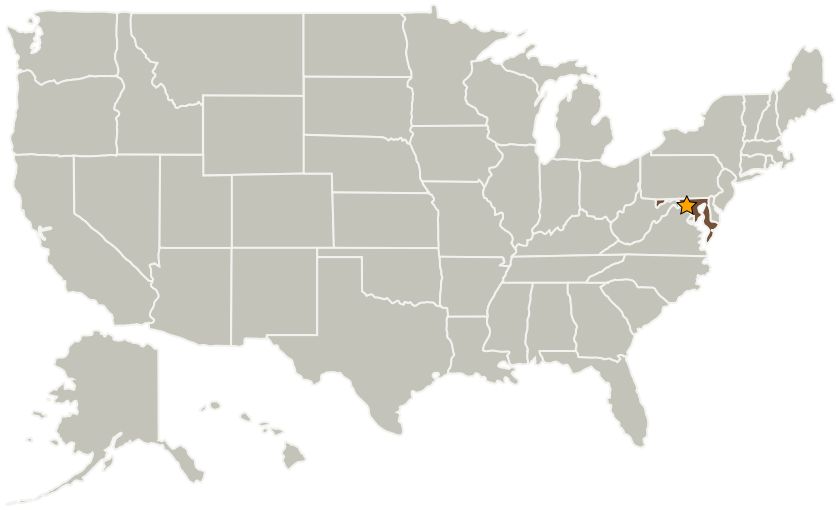
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Maryland

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Managers:

Matthew J Mcgill
William E Cutlip

Principal Investigator:

Stephen J Munchak

Co-Investigators:

Ian S Adams
Jeffrey R Piepmeier
Gail S Jackson
Sergey Krimchansky
Michael A Solly
Giovanni De Amici

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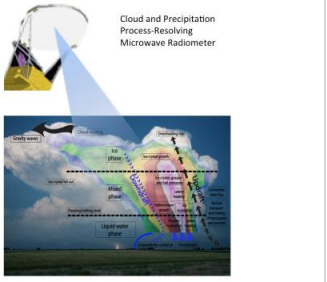
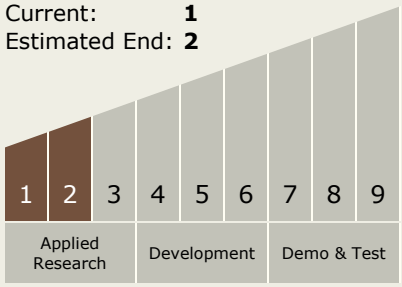
Images



A Cloud and Precipitation Process-Resolving Microwave Radiometer
A schematic diagram of a thunderstorm with internal microphysical processes labeled (courtesy of Sue van den Heever and Rob Seigel, Colorado State University).
(https://techport.nasa.gov/image/28228)

Technology Maturity (TRL)

Start: **1**
Current: **1**
Estimated End: **2**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves

Target Destination

Earth

Supported Mission Type

Projected Mission (Pull)